

REMARKS

Claims 1 - 19 are pending in the application.

Claim 1 and dependent claims 3-8 have been amended to indicate the at most partially solidified molten metal is introduced into a chamber with a lower wall and an upper wall being divided into compartments. Claims 1 and 3-8 are supported by Fig. 1, showing chamber 2 with compartments 5, 6 and 7 formed with walls 8 and 9, and by the disclosure in the specification on page 5, line 25 through page 6, line 6.

Claim 11 is amended as supported at page 1, second paragraph.

New Claim 16 is supported by original claim 3.

Claim 17 recites the temperature difference of claim 2 and recites the aluminum with lower Fe-content crystallizes as the crystals formed and/or existing in the layer of metal in the compartments while the molten aluminum is enriched with Fe as supported at page 7.

New Claim 18 is supported by original claims 11 and 12.

Claim 19 is original claim 14 rewritten in independent form.

It is respectfully submitted the above amendments present no new matter.

I. Claim Objection

Applicants thank the Examiner for indicating Claim 14 has been objected to as being dependent upon a rejected base claim, but is deemed to be allowable if rewritten in independent form including all of the limitations of the base claim 1.

II. 35 U.S.C. §102(b) and 35 U.S.C. §103(a)

Claims 1, 11 and 12 stand rejected under 35 U.S.C. §102(b) as anticipated or under 35 U.S.C. §103(a) as being unpatentable over Japanese patent document 07-070666 (JP '666) (based on English translation).

With respect to claims 1, 11 and 12, JP '666 is said to disclose a method and apparatus for continuous refining of aluminum scrap comprising an Fe-removing process of crystallization separating Al-Si-Fe-Mn from aluminum by crystallization and refining process to produce hypoeutectic Al-Si with low Fe content (JP '666 claim 1) where the Al-Si-Fe-Mn compounds are crystallized and removed by suction (JP '666

claim 2) and the hypoeutectic alloy is solidified and removed along the horizontal direction (JP '666 claim). It is then asserted that JP '666 discloses a fractional crystallization process, where the Fe-removing process (p. 6) fractionally crystallizes Al-Si-Fe-Mn compounds and is in series with three refining steps (pp 6-7) each of which fractionally crystallizes the hypoeutectic Al-Si alloy as shown on Figure 1. Figure 1 is relied upon for the depiction of compartments (9), (2), (3) and (4) in series communication. Figure 3 is then cited as allegedly depicting at least some of the crystals (intermetallic compounds C2) are removed in a direction perpendicular to the remaining melt (M3).

The present amended claims recite the compartments are in a single chamber divided into a number of compartments by compartment walls. In contrast, JP '666 describes a method that uses a number of refining furnaces arranged in a multistage mode and connected with each other by a number of pipes. JP '666 thus does not disclose or suggest the presently claimed method of using one chamber divided into compartments by compartment walls. The present method provides a more economical and efficient method and apparatus than the JP '666 arrangement.

The Office Action additionally asserts although JP '666 does not specifically recite the molten metal is transported in a direction "opposite" that of the crystals, the configuration would be a matter of choice which a person in the art would have found obvious lacking evidence that the particular configuration is significant.

Applicants urge that even if the transportation of molten metal in JP '666 was made opposite of the crystals, the process still would not disclose or suggest the claimed process using a single chamber and compartments. Moreover, the opposite flows through a single chamber are advantageous, for example, to permit separating aluminum with lower Fe-content crystals from molten metal enriched with Fe as recited by present claim 17.

JP '666 describes a method of refining aluminum scraps involving crystallization-separation of Al-Si-Fe-Mn type intermetallic compounds. However, in the cited JP '666 method, the Al-Si-Fe-Mn type intermetallic compounds are crystallized, leaving the aluminum melt with lower Fe content. The present chamber permits an opposite process wherein, in a respective chamber, aluminum with lower Fe-content crystallizes

while the molten aluminum is enriched with Fe. This follows from the temperature gradient of claim 2 and is emphasized by new claim 17.

Applicants submit claim 1, as amended, and the claims directly or indirectly dependent thereon patentably distinguish over JP '666 for the reasons set forth above. Applicants therefore request the rejections of the claims over JP '666 be withdrawn.

III. 35 U.S.C. §103(a)

- A. Claims 1-10, 13 and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hall (U.S. Pat. No. 1,938,101) in view of Perry's Chemical Engineers' Handbook (Perry's Handbook)

With respect to claim 1, Hall is said to disclose a metal refining process for removal of other metals from lead (p.1 lines 1-4) and that "[T]he process consists of a series of crystallizers (C1-C13), which are in communication via launders (L1-L12) as shown in Fig. 2." The liquid level in each crystallizer is determined by at least as a lower level at the bottom of the crystallizer and an upper level set at the predetermined heights to permit transport of the melt via differences in the head in each crystallizer compartment by screws S1-S13 (page 2 lines 129-133) whereas the liquid is removed to the next crystallizer in series via launders (p. 2 lines 104-127). It is acknowledged in the Office action that Hall does not teach the directions of flow are opposite. The Office action asserts Hall Fig. 1 depicts flow at about 90 degrees for screws and launders in Fig. 1. Applicant notes Hall's text does not expressly disclose flow at about 90 degrees for screws and launders. The Office action concludes the configuration of opposite flow is a matter of choice lacking evidence that the particular configuration is significant.

Applicants assert Hall describes a process of refining lead from impurities such as bismuth or antimony. The process and apparatus of Hall uses a large number of kettles connected with each other by screws and launders. In contrast, the presently claimed process uses a single chamber divided into compartments by compartment walls in the chamber. This provides a more efficient process than that of Hall.

Regarding claim 1, Perry's Handbook has been cited to show stirring as a means for agitation of liquid-solid processes is known. Regarding claim 9, Perry's Handbook has been cited to show mixing speed is a variable which affects performance

characteristics such as mixing time and power consumption and optimization by variation of mixer speed would have been obvious.

However, Perry's Handbook does not make up for the deficiencies of Hall regarding base claim 1 discussed above, claim 2 or new claims 17 or 18. For example, Perry's Handbook does not disclose or suggest the use of a single chamber with compartments made with compartment walls within the chamber in communication. Applicants therefore submit the claimed invention has overcome this rejection and respectfully request this rejection be withdrawn.

B. Claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over JP '666 in view of Perry's Handbook

JP '666 has been applied as to claim 1 above.

The Office action asserted although JP '666 does not recite that mixing velocity is controlled as a variable, Perry's Handbook teaches that mixing speed (i.e. velocity) is a variable which affects performance characteristics such as mixing time and power consumption (pp. 18-5 to 18-13). Therefore, optimization in the process of JP '666 would have been obvious to one of ordinary skill in the art.

However, Perry's Handbook does not make up for the deficiencies of JP '666 discussed above regarding base claim 1 or new claim 17. For example, Perry's Handbook does not disclose or suggest the use of a single chamber with compartments made with compartment walls within the chamber in communication. Applicants therefore submit the claimed invention has overcome this rejection and respectfully request this rejection be withdrawn.

IV. Allowable Subject Matter

Applicants again thank the Examiner for indicating allowable subject matter in claim 14, if rewritten in independent form to include all the limitation of previous claim 1. Claim 19 is original claim 14 rewritten in independent form.

V. Conclusion

Applicants submit all the objections and rejections are overcome. Thus, a timely Notice of Allowance is therefore respectfully requested.

Respectfully submitted,

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